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UNITED STATES DEPARTMENT OF AGRICULTURE  
AGRICULTURAL RESEARCH SERVICE  
ANIMAL DISEASE ERADICATION DIVISION  
WASHINGTON 25, D. C.

REPORT OF COOPERATIVE CATTLE  
FEVER TICK ERADICATION ACTIVITIES

FISCAL YEAR

1962

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## THE ERADICATION PROGRAM

Cattle fever ticks Boophilus annulatus and B. microplus spread bovine piroplasmosis--a severe and often fatal disease of cattle. It is also known as cattle tick fever, southern cattle fever, splenetic fever, and Texas fever.

Tick larvae hatch from eggs laid on the ground, become attached to animals occupying infested premises, feed upon the host animal--and thus transmit the disease--molt, mate, and the engorged female drops to the ground to deposit her eggs and thus the ticks are perpetuated.

For almost 150 years, much of the southern and southwestern United States was infested with cattle fever ticks. Tick fever caused great losses to cattlemen year after year. Research by the U.S. Department of Agriculture, which began in the 1880's, proved that the disease is caused by Babesia bigemina and transmitted by the cattle tick, showing for the first time that infectious diseases could be spread from one animal to another by an arthropod carrier or vector. This discovery was a milestone in the conquest of this and other diseases.

When considering measures for eradicating the cattle fever tick, it is evident that it can be attacked in two locations--in the pasture and on the host. Animals may be freed of ticks in two ways: with a tickicide that kills the ticks, or they may be pastured at proper intervals on tick-free fields until all the ticks have dropped. Dipping is the method generally used. The pasture-rotation method is more complicated and tick-free fields are seldom available.

In freeing pastures the method followed may be either direct or indirect. The direct method consists in excluding all cattle, equines, sheep, goats, and deer from the pasture until all the ticks have died of starvation. The indirect plan consists in permitting the cattle and other animals to remain on the infested pasture and treating them at two-week intervals with agents destructive to ticks, thus preventing engorged females from dropping to lay eggs and reinfest the pasture.

All the seed ticks on the pasture, or those that hatch from eggs laid by females already there, will die eventually. Those that get on the cattle from time to time will be destroyed by the treatment, while those that fail to find a host will starve in the pasture.

Using these principles an all-out eradication program was instituted in 1906. 37 years later, in 1943, the tick had been eradicated from the United States, except for a narrow buffer zone, under Federal and State quarantines along the Texas-Mexico border. There, reinfestations occur from time to time and an active program is required to prevent additional spread into adjacent areas. Reinfestations have also occurred in California and in Florida from time to time.

The eradication program includes inspection, quarantine, and dipping of infested animals.

## PROGRAM GOALS

Prevention--keeping the ticks out of the United States--is a major part of the effort against cattle fever ticks. A quarantine zone is maintained along the international boundary and the lower Rio Grande River in 8 Texas counties as adjacent areas in Mexico are infested. Cattle from Mexico are carefully inspected for ticks at the border. They must be free of ticks and must be given a precautionary dipping before they can be imported.

Without these controls, cattle fever ticks would reinfest areas of the United States that have warm climates. In spite of continued efforts to keep out these parasites, they have reappeared from time to time, but vigilance and prompt eradication measures have eliminated the outbreaks.

Should the ticks gain a foothold, piroplasma-carrier cattle imported from Mexico could furnish reservoirs leading to heavy losses in our cattle population.

## INSPECTIONS AND/OR DIPPINGS - FISCAL YEARS 1959 THROUGH 1962

Fiscal Years	Inspected and/or Dipped Herds	Number of Infested Herds
1962	181,764	2,397,944
1961	118,462	2,593,659
1960	104,554	1,685,283
1959	117,406	2,097,587

## FURTHER WORK INDICATES BOOPHILUS MICROPLUS ERADICATED FROM FLORIDA

Additional work in Florida indicates that cattle fever ticks have been eradicated from Florida where 16 premises in Martin, Palm Beach, Osceola, Indian River, and Hillsborough Counties had been infested in fiscal year 1961. Systematic inspections and dippings of cattle and horses were completed but surveys to detect any additional tick infestation continued.

55,970 herds of 838,285 cattle were inspected and/or dipped in fiscal year 1962, compared to 5,092 herds of 122,244 cattle the previous year.

The outbreak was discovered in May 1960 at the Okeechobee Livestock Market by a State inspector. An active cooperative eradication program was immediately begun. It included establishing the State Tick Quarantine Line crossing Florida at Ocala--located at the former screwworm quarantine line established in May 1958 and discontinued in November 1959. Florida regulations required inspection and dipping of animals moving north across the quarantine line. Systematic inspections were made of all cattle and horses south of the quarantine line. The program also included inspection of cattle at slaughter houses and inspection and dipping of cattle at auction markets. Infested and exposed herds were dipped routinely for a period of one year.

The campaign was pronounced successful in October 1961. The most recent finding of cattle fever ticks in Florida was on September 26, 1960.

### Previous Outbreaks in Florida

Previously, in April 1957, cattle fever ticks (*B. microplus*) were found at the Okeechobee Livestock Market; and during the summer of 1957, 8 infested herds were found in Okeechobee County, 3 in Broward, 2 in Highlands, and 1 each in Dade and Palm Beach Counties. The campaign to eradicate the ticks was pronounced successful in September 1958, more than a year following the last known infestation.

During fiscal year 1947, infestations were reported in Palm Beach, Broward, Charlotte, Collier, Dade, Hendry, and Lee Counties and during fiscal year 1948 in Volusia, Putnam, Flagler, Brevard, Osceola, Lake, St. Johns, Alachua, Orange, Madison, and Jackson Counties in Florida and on one premises in Brantley County, Georgia. Movements of cattle from Volusia County caused widespread dissemination of the ticks. Systematic inspections and dippings brought the outbreak under control, and the remaining Federal quarantines were removed in December 1950.

A previous outbreak of cattle fever ticks occurred in Okeechobee County in the winter of 1945 when quarantines were placed on that county as well as on Glades and Highlands and parts of Osceola and Polk Counties.

Florida was the last State, with the exception of Texas where a narrow buffer zone along the international border is still under Federal and State quarantine, to be freed of fever ticks. The remaining Federal quarantine in Collier and Hendry Counties in the Big Cypress Swamp area was lifted in December 1943. An active eradication program had begun 20 years earlier, in 1923, and involved the slaughter of deer in order to eliminate the tick.

### PROGRESS IN CALIFORNIA AND IN PUERTO RICO

The cattle fever tick was eradicated from California many years ago. However, this State also has a common border with infested areas in Mexico, and animals illegally entering the United States reintroduce ticks from time to time.

The most recent California infestation, in San Diego County, was discovered in Marron Valley in June 1956 and has been eradicated.

Previous outbreaks in Marron Valley and Tijuana Valley in San Diego County and in Los Angeles County include those in 1950, 1949, 1944, 1943, and 1941.

In Puerto Rico an active tick eradication program began in 1936. Here, the tropical variety of the fever tick, *B. microplus*, was prevalent and it was necessary to treat sheep and goats as well as equines and cattle, and to slaughter deer.

No cattle fever ticks have been found since December 1952. Systematic dippings were discontinued in May 1953 and systematic inspections discontinued in June 1954.

# STORY OF TICK ERADICATION

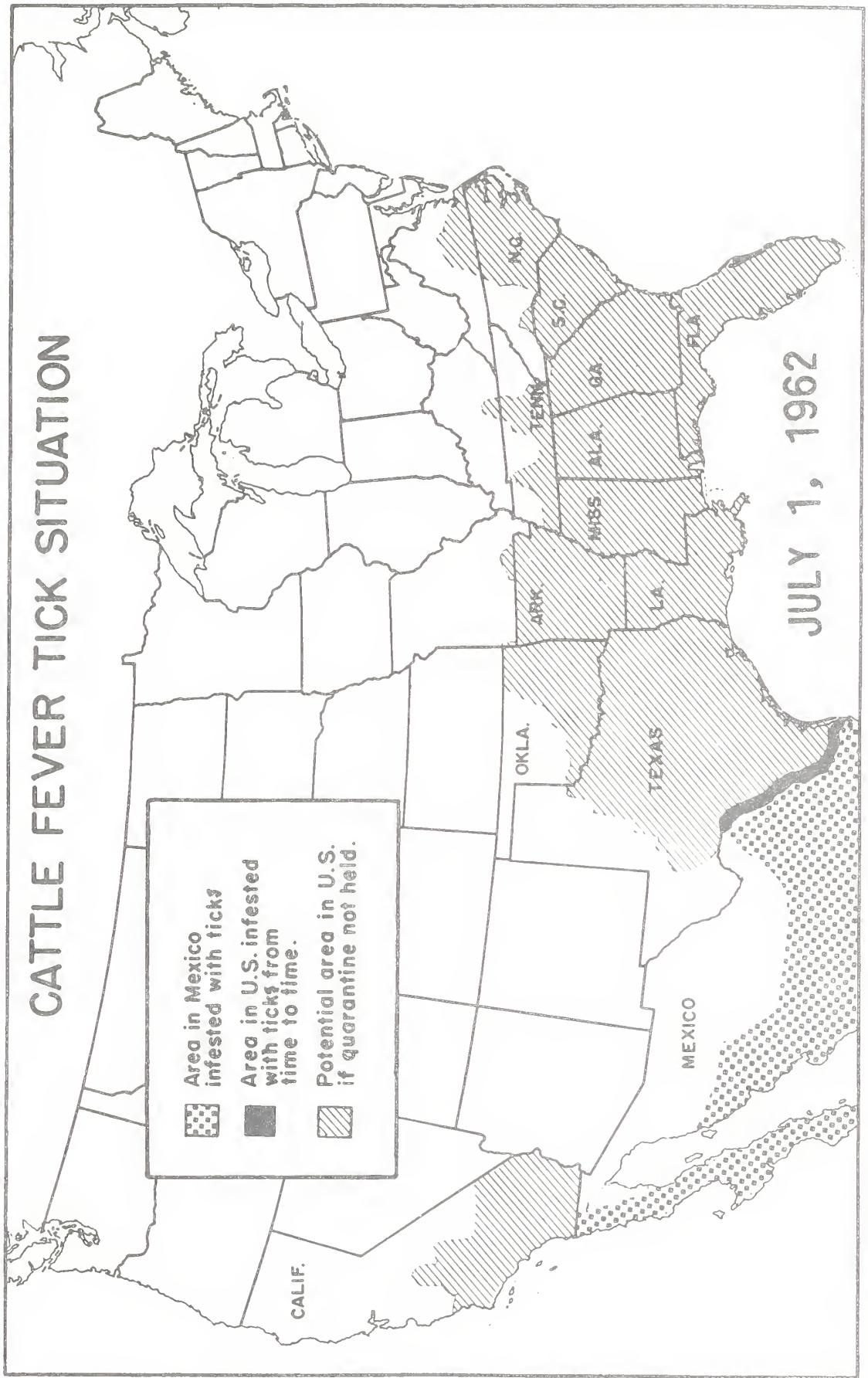


■ AREAS INFESTED WITH CATTLE FEVER TICKS

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# CATTLE FEVER TICK SITUATION



## ACTIVE PROGRAM CONTINUES IN TEXAS

All territory in Mexico adjacent to the international boundary along the lower Rio Grande River is tick infested, and reinfestations in Texas by ticks carried by Mexican animals illegally entering the United States occur regularly. The river, serving as the boundary, is not an effective barrier against such illegal movements. A buffer area, under Federal and State quarantine, extends from Del Rio to the Gulf of Mexico, approximately 500 miles. This zone is constantly patrolled by Department inspectors who, in cooperation with Texas livestock sanitary authorities, work diligently to reduce the introduction and prevent the dissemination of the ticks. The area under quarantine includes parts of Cameron, Hidalgo, Kinney, Maverick, Starr, Val Verde, Webb, and Zapata Counties.

REPORT OF ACTIVITIES IN BUFFER AREAS  
FISCAL YEARS 1959 THROUGH 1962 AND IN 1952

<u>Illegally Entering Mexican Livestock Caught</u>	1962	1961	1960	1959	1952
Equine - tick-infested	120 - 9	61 - 2	41 - 3	15 - 0	1,873 - 183
Cattle - tick-infested	59 - 26	17 - 8	50 - 21	15 - 5	147 - 82
Sheep and Goats - tick-infested	5 - 0	1 - 0	1 - 0	0 - 0	0 - 0
<u>American Livestock Straying to Mexico and Returning</u>	17 - 0	8 - 0	31 - 0	8 - 0	7 - 0
<u>Inspected for Ticks</u>					
<u>Systematic Area</u>					
Herds	42,298	35,269	35,380	30,955	32,363
Livestock	926,872	739,959	741,286	690,307	558,809
<u>Final Area</u>					
Herds	14,879	15,653	12,771	13,067	12,011
Livestock	297,304	293,830	304,590	292,309	168,088
<u>Dipped for Ticks</u>					
<u>Systematic Area</u>					
Herds	10,424	10,332	9,556	9,918	13,845
Livestock	56,655	58,201	52,743	51,706	81,685
<u>Final Area</u>					
Herds	641	529	382	340	113
Livestock	2,184	4,950	1,047	1,209	1,323
<u>Intrastate Certificates Issued</u>					
Number of Certificates	14,023	13,046	12,435	12,206	14,913
Number of Livestock	123,257	83,952	76,659	28,268	57,704
<u>Interstate Certificates Issued</u>					
Number of Certificates	65	66	172	312	13
Number of Livestock	7,205	12,668	21,390	14,511	808
<u>Herds Held for Further Treatment</u>					
<u>Systematic Area</u>	14	5	17	3	92
<u>Final Area</u>	0	4	4	0	0
<u>Tick-Infested Herds Found</u>					
<u>Systematic Area</u>	21	1	4	2	29
<u>Final Area</u>	0	0	0	0	1
<u>Exposures to Clean Premises</u>	16	25	17	4	108
<u>Re-exposures to Held Premises</u>	5	1	4	0	73

## AFRICAN TICKS FOUND IN FLORIDA AND NEW YORK

On October 31, 1960, African ticks were found on zebras at Busch Gardens, Tampa, Florida, by the director of the Gardens. Inspection by regulatory veterinarians revealed that 7 of the 10 zebras were infested. The ticks were identified at Sebring, Florida, and at Beltsville, Maryland, as Rhipicephalus evertsi, and R. pulchellus. The 10 zebras had been delivered to the Gardens on October 28. They had been trucked from the Clifton, New Jersey Quarantine Station where they had undergone a 30-day quarantine following shipment from Mombasa, Kenya, East Africa, by ocean vessel. Other zebras in the shipment had been trucked to the Catskill Game Farm, Catskill, New York, and one remained at the quarantine station. The latter animal was tick-free; however, inspectors from the quarantine station and in New York State found two of the three zebras shipped to Catskill to be infested with the African ticks.

Both premises were placed under State and Federal quarantines, and infested and exposed animals, trucks, and premises were treated with acaricides. The truck hauling the infested zebras to Florida had, on the return trip, loaded cattle in Tennessee and Virginia. The truck and cattle were located in New York State prior to unloading. The truck was cleaned and disinfected and the possibly exposed cattle treated twice. The premises in Tennessee and Virginia were treated also. The exposed facilities in the latter State had been used prior to treatment for loading a shipment of cattle to Indiana. These animals and the truck involved were treated in Indiana as a precautionary measure.

Other zoo animals in the African shipment had been shipped by air from the quarantine station to the San Diego, California, Zoological Gardens, and by truck to the Detroit, Michigan, Zoological Park, Woodland Park, Seattle, Washington, Zoological Gardens, and to Thousand Oaks, California. En route 13 llamas were loaded on the truck at the Brookfield, Chicago, Illinois, Zoo and taken to California. Another truck transported animals in the African shipment to the National Zoological Park, Washington D. C. No ticks were found on any of these animals or on those which remained at the Clifton Quarantine Station. However, animals in the African shipment and other animals and the trucks and premises involved were treated as a precautionary measure.

Africa U.S.A., Boca Raton, Florida, presented a particularly difficult problem. Here, ticks collected by a livestock inspector in September 1960, were identified as R. evertsi. It was a double-fenced tourist attraction consisting of 130 acres of grassy plains, desert-like sandy areas, and woodland with several small streams and lakes. In the compound some 350 African animals, including giraffe, camel, zebra, eland, Abyssinian ass, blackbuck gazelle, auodad, nilghai, and ostrich roamed freely. Two tethered Asian elephants completed the assortment.

Rhipicephalus ticks are two-host ticks with unfed adults able to survive for up to 14 months.

Fortunately intensive surveys in circumjacent areas indicated the ticks had not spread beyond the wild animal farm.

Animals were immobilized for inspection by the use of "Cap-Chur" guns using CO<sub>2</sub> to propel a projectile syringe containing succinyl choline.

Developing an effective eradication program was an interesting and intriguing challenge. The wide variety of the wild animals made a successful routine dipping or spraying operation quite difficult. It was decided rather to treat the entire compound repeatedly with a tickicide. DDT was chosen and 6 applications of DDT-suspension sprays were made to the ground and vegetation in the compound at the rate of 2 lbs of DDT per acre and at 3-week intervals. Two treatments of dieldrin, each at the rate of 1.5 lbs. active ingredient per acre, were applied around the periphery of the compound.

Following the six ground treatments, begun in November 1960, inspection of 73 animals in February and March 1961 revealed 71 male and one female Rhipicephalus evertsi ticks. Four additional similar ground applications of DDT were then made.

In September 1961, seven weeks following the 10th ground treatment, each animal was inspected, no ticks were found, the animal was treated, placed in a tick-free environment, reinspected in 7-10 days, again treated and then released from quarantine. Mammals were sprayed with 0.2 percent Delnav and each ear treated with  $\frac{1}{2}$  oz. pure pine oil containing 1.0 percent lindane. Five percent DDT dust was applied to the ostriches. The last animal was inspected and removed from the compound in January 1962.

Quarantines were then removed from the premises which are no longer used as animal holding facilities.

These strenuous efforts to eradicate exotic ticks have apparently been successful and represent the only known successful efforts to eradicate these parasites from an infested country.

## OTHER REPORTS RECEIVED AND ACTIVITIES OF INTEREST

Amendments to 9 CFR, Part 72, Texas (Splenic) Fever in Cattle

During the past two fiscal years, amendments were made to the Federal regulations as follows:

In August 1960 an amendment made appropriate changes in the quarantine line along the tick buffer area in southern Texas.

In July, August, September, November, and December 1960, and in March, September, and October 1961, and in March 1962, amendments added certain areas in Florida and New York to those areas regulated because of Boophilus annulatus, B. microplus, or Rhipicephalus evertsi infestation, and removed such areas from a regulated status when the tick infestations had been eradicated.

In September 1960, an amendment recognized a change in nomenclature from Margaropus annulatus to Boophilus annulatus and included B. microplus by name within the scope of the regulation.

In October 1960 Delnav emulsifiable concentrate maintained at a concentration of .15 percent was added to the list of permitted dips. During the same month an amendment included within the provisions of the regulation in Parts 71 and 72 the fever carrying tick Rhipicephalus evertsi evertsi and made the provisions of paragraph 72.1 and 72.21 applicable to any animals which are tick-infested or exposed to tick infestation.

Lists of Permitted Dips Brought up to Date

ADE Division Memorandum No. 510.17, pertaining to arsenical dips, was issued on March 1, 1962.

Inspection Facility and Cattle Dipping Vat Plans Developed

During the fiscal year, a three-page plan showing details of recommended cattle inspection facilities and a dipping vat was completed jointly by members of the Division and personnel of the Agricultural Engineering Research Division, ARS. The plans were printed and distributed to ADE stations. The prints will also be available in each State through the Cooperative Extension Service. These plans are a composite of a large number of plans reviewed and include the best features of all.

Leaflet PA-475 "The Fight Against Cattle Fever Ticks" Issued

This program aid describing the life cycle of the tick and the eradication program was issued in December 1961. It was written primarily for use by ranchers, farmers, and other members of the livestock industry and has been distributed widely.

Field Manual on Veterinary Entomology for Animal Disease Eradication Division Personnel Begun

This proposed field manual was begun with the preparation and distribution of the section on ticks. Material of this nature has been needed for some time and the section on ticks is enjoying gratifying acceptance by Division personnel and by workers in several related fields.

There are some 400 species of ticks in the world, about 65 or 70 of which are found in the United States. Of the latter about 15 are of interest as vectors of animal diseases.

The material distributed includes descriptions of ticks, drawings, keys for identification, life histories and habits, diseases transmitted, and other pertinent information.

Tick Eradication Training Courses Continue

Since July 1960, several tick eradication training courses have been held at Laredo, Texas. Five such courses were held in 1960 and were attended by Animal Disease Eradication Division, Animal Inspection and Quarantine Division, and State personnel from California, Texas, Mississippi, Florida, Oklahoma, Virginia, Alabama, Louisiana, Tennessee, Georgia, Arkansas, Kentucky, New Mexico, North Carolina, South Carolina, New York, and Washington, D. C.

The purpose of the training courses is to acquaint regulatory personnel with the tick problem, and to train them in the fundamentals of identifying cattle fever ticks, other ticks, and in the principles of tick eradication including inspection, quarantine, and dipping procedures.

Four similar courses were held during August, September, and October 1962.

Color Slide Kits Developed

In September 1961, a kit of 51 color slides--The Red Tick in "Africa USA," Boca Raton, Florida--was developed. Accompanying narration material was also prepared. The slides illustrate geographical features, exotic animals, and procedures involved in eradicating Rhipicephalus evertsi ticks from "Africa USA."

Previously a kit of 29 color slides was duplicated showing experimental sweating sickness--in cattle, sheep, and swine--with appropriate narration material. This tick-transmitted condition is an important cattle disease in Africa.

Picture Story No. 128

This picture story illustrates the procedures used to eradicate cattle fever ticks from Florida.

#### Field Trials with Acaricides

Dipping trials were continued in Texas, New Mexico, Arizona, Colorado, California, and Wyoming to establish accurate vat management and replenishment procedures to maintain the proper concentration of dips using chemicals for which no vatside test is available. Field trials disclosed that the vatside tests for Delnav and for toxaphene were unsatisfactory, and the trials were useful in establishing proper replenishment ratios and vat management practices.

Cooperative field research trials were conducted in Mexico in cooperation with the Mexican Department of Agriculture, various Mexican ranchers, and the following U.S. Department of Agriculture agencies: Entomology Research Division--Livestock Investigations Laboratory at Kerrville, Texas; Animal Disease and Parasite Research Division; and Animal Inspection and Quarantine Division.

Chemicals used were arsenic, Delnav, Co-Ral, and Korlan.

#### Useful Working Draft Prepared - "Determining Field Efficacy of Acaricides Being Considered for Addition to List of Permitted Dips"

A working draft with this title was distributed in December 1961 to provide a guide for manufacturers interested in qualifying their products for addition to the list of permitted dips. The draft also furnishes regulatory employees guidelines for participating in field trials designed to determine the efficacy of chemicals as acaricides and to establish accurate vat management procedures.

#### Acaricide Evaluation Questionnaire and Recording Forms Developed

This questionnaire provides a convenient means for summarizing research and field data pertinent to the efficacy of an acaricide as a permitted dip and for developing practical and safe procedures for its use. Forms for recording information (ADE Forms 5-14a through 5-14h) useful for developing and recording pertinent data were developed also.

#### Division Chemical Laboratory, Laboratory Services, Beltsville, Maryland, Reports Progress in Analysis of Dip Samples

The capability for conducting quantitative analysis of dip samples on a mass production basis was developed at the ADE Division Chemical Laboratory, Laboratory Services, Beltsville, Maryland. The laboratory was relocated to new facilities during the year and has made considerable progress in servicing the tick program.

Quantitative analysis tests from October 1, 1961, through June 30, 1962, included the following: Toxaphene, 637; Delnav, 23; Co-Ral, 55; Lindane, 48; and Korlan (Ronnel), 13. Also, 16 series of emulsion stability tests were conducted.

#### Cattle Fever Ticks (*Boophilus microplus*) found on Deer, Sheep, and Goats in the Virgin Islands

The role of wild life, particularly deer, in perpetuating cattle fever tick populations has at times been controversial. On several recent occasions ticks, identified as *B. microplus* in the laboratory, have been found infesting deer. This supports evidence of long standing that deer serve as hosts for the tick. It was also proved that engorged female ticks removed from deer oviposited.

*B. microplus* were also found on sheep and goats. Thus deer, sheep, and goats also serve as a host for the tick and must be considered in an effective eradication program.

#### Additional Tick Infested Areas Disclosed in Sonora, Mexico

Shipments of Mexican cattle from areas believed free of cattle fever ticks (*Boophilus annulatus*) were rejected for entry at Douglas, Arizona, a border entry point, in November and December 1961, and again in May 1962. Cattle were rejected when Animal Inspection and Quarantine Division port inspectors found cattle fever ticks. The tick-infested cattle must be freed of the ticks and held in a tick-free environment for 60 days before being eligible for entry through the Douglas port of entry.

Cattle fever ticks are not often found at ports of entry in California, Arizona, and west Texas, but are frequently found on cattle offered for entry at southern Texas ports.

#### Tropical Horse Ticks (*Dermacentor nitens*) Found in Florida

*D. nitens* ticks have been reported in Mexico, Central America, and other countries, and in Puerto Rico, the Virgin Islands, southern Texas, and more recently in Florida. In Florida surveys disclosed *D. nitens* infesting equines, cattle or deer in Santa Rosa, Holmes, Marion, Volusia, Orange, Hillsboro, Brevard, Indian River, Okeechobee, Monatee, Highlands, De Soto, Sarasota, Glades, Hendry, Palm Beach, Collier, Broward, Dade, and Monroe Counties.

This tick may be serving as a vector for equine piroplasmosis recently diagnosed in Florida.

#### Training in Zoo Animal Immobilization Techniques

The Division, in cooperation with the States of Florida and Georgia, conducted a zoo animal immobilization training course using "Cap-Chur" gun equipment. The course commenced at Atlanta, Georgia, on February 20, 1961. The first week of training was divided between Atlanta and the School of Veterinary Medicine, University of Georgia, Athens, Georgia. The second week was at "Africa, U.S.A." in Florida. Nine veterinarians from the States of California, Florida, Georgia, Nebraska, New York, Ohio, and Texas received the training.

### POTENTIAL DANGERS OF EXOTIC ECTO-PARASITES

The threat of introducing exotic ecto-parasites and diseases is probably greater today than at anytime in our history. Modern, rapid transportation with all the advantages it has brought has also confronted us with new problems that our predecessors generally did not have. It is now possible to load animals on swift ocean-going vessels in Africa, Asia, or Europe--and within only a few days, they are at one of our ports of entry. With air transportation--and more and more animals are being shipped by air each year--the time interval from departure to arrival is measured in hours, rather than days.

The ticks, of all the arthropods, are the most notorious vectors of livestock diseases. We here are very fortunate as we have few ticks capable of causing the damage that the ticks cause in Africa and in other areas.

Eradication of many exotic species would probably be impossible once they became firmly established. It is true that we have eradicated the Boophilus ticks from the United States, and though this was a very difficult and costly task, it would seem a minor accomplishment when compared to the problem of eradicating certain exotic species.

The Boophilus ticks are more easily eradicable because they are one-host ticks, and the bovine is the primary host. They spend all their parasitic life cycle, that is as the larvae, nymph, and adult, on the same host.

Many of the exotic ticks, however, are two or three-host ticks. Although the biology varies from species to species, the larval stage is generally spent on birds or small rodents after which it drops off and molts to the nymphal stage. The nymphal stage of the tick may attach to a rodent or some small wild or domestic animal, engorge, and drop to the ground to molt to the adult stage. The adult usually attacks larger wild or domestic animals.

Thus, two and three-host ticks are extremely difficult to eradicate since it would be next to impossible to control the immature stages on the wildlife. Many of the immature and mature stages can survive for long periods without a blood meal. The danger of introducing exotic ticks and the difficulty of eradicating them, should they become established, is further complicated by the fact that strains resistant to pesticides have developed. Transovarial transmission of diseases through several tick generations adds additional problems.

### SOME OF THE MORE IMPORTANT DISEASE-TRANSMITTING TICKS THAT COULD BE INTRODUCED

The Hyalomma, Rhipicephalus, Boophilus, Amblyomma, Haemaphysalis, and Ixodes are the more important tick genera although there are also other genera of economic importance.

The brown ear tick, R. appendiculatus, is a particularly important parasite in Africa. It is probably the most important vector of East Coast fever as well as a transmitter of pseudo-East Coast fever, piroplasmosis, Nairobi sheep disease, and Boutenueuse fever in man. Experimentally, this species has transmitted louping-ill and Rift Valley fever.

The African red tick, R. evertsi, is a known vector of East Coast fever, pseudo-East Coast fever, bovine and equine piroplasmosis, spirochetosis, and probably several other diseases of livestock.

A. variegatum is known to transmit heartwater (Rickettsia ruminantium), bovine lymphangitis and Nairobi sheep disease.

A. hebraeum is also a vector of heartwater.

The Hyalomma ticks are chiefly parasites of domestic animals and are of considerable importance. They appear to be unusually efficient vectors of many disease-causing organisms. In their immature stages, they often feed on birds, rodents, and hares that are important reservoirs of pathogens, especially viruses and rickettsiae. The range of Hyalomma covers, in a large part, a vastly underdeveloped part of the world and they are economically among the most important of animal ectoparasites.

### ANIMAL DISEASES WHICH CAN BE INTRODUCED BY EXTERNAL PARASITES

Animal diseases which can be introduced by external parasites include the following: African horsesickness; anaplasmosis; bluetongue; borna disease; corridor disease; East Coast fever; pseudo-East Coast fever; encephalomyelitis--Western, Eastern, and Venezuelan; ephemeral fever; heartwater; lamb paralysis; louping-ill; bovine lymphangitis; Nairobi sheep disease; tick paralysis; bovine piroplasmosis; canine piroplasmosis; equine piroplasmosis; European cattle piroplasmosis; tropical piroplasmosis; ovine piroplasmosis; porcine piroplasmosis; canine rickettsiosis; bovine rickettsiosis; Rift Valley fever; surra; sweating sickness; spirochetosis of cattle, horses, sheep, and goats; theileriosis of sheep and goats; tropical theileriosis; trans-caucasian fever; tzaneen disease; Wesselsbron disease; and others.

## EXOTIC TICKS COLLECTED AT WILD ANIMAL COMPOUNDS AND ZOOLOGICAL PARKS

Following the finding of Rhipicephalus evertsi ticks on imported zoo animals, a number of zoological parks were visited and studied to determine the potential of such environments in the propagation of arthropod vectors of disease and the hazards of such vectors to the livestock industries of the United States. The zoological parks visited were representative of such parks in general and included the National Zoological Park, Washington, D. C.; Washington Park Zoo, Portland, Oregon; San Francisco Zoological Gardens, San Francisco, California; San Diego Zoological Gardens, San Diego, California, Griffith Park Zoo, Los Angeles, California; and New York Zoological Park, New York, New York.

Zoological parks acquire wild animals by trade or purchase from other zoos, both foreign and domestic, or by purchase from importers or breeders of wild animals. The present trend seems to be that wild and exotic animals are maintained in more natural environments in the country, often close to domestic animals, rather than being confined in zoological parks located within city boundaries. This, of course, increases the danger of parasites of wild animals spreading to domestic animals. The fact that wild animals are purchased by private persons for "hunting preserves" adds to the problem.

Ordinarily the temperature, moisture, altitude, availability of host animals, and other environmental factors determine the likelihood of exotic ticks continuing their life cycles and becoming established in wild animal compounds and zoos. It is quite possible that some species of ticks could survive and multiply in zoo environments, and be dispersed through movement of zoo animals or by rats, squirrels, rabbits, birds, etc.

Ticks collected from zoo animals and reptiles at zoos and animal farms in Texas, Illinois, Michigan, California, Pennsylvania, New York, and Florida collected from eland, nilghai, oryx, zebra, zehorse, camel, Abyssinian ass, hartebeest, giraffe, rhinoceros, pangolin, porcupine, or several species of reptiles include the following: Amblyomma gemma; A. sublaeve; A. longirostre; A. rotundatum; Amblyomma or Hyalomma spp.; Ixodes hexagonus; Dermacentor reticulatus; Aponomma tatum or A. spp.; Rhipicephalus evertsi evertsi; R. evertsi mimeticus, or R. pulchellus.

## EXOTIC TICKS FOUND ON ANIMALS AND MATERIALS OFFERED FOR IMPORTATION

Often, animals and materials to be offered for importation are infested with ticks and other external parasites when they leave the country of origin. During recent years, Department inspectors in the course of their duties have collected various species of ticks from animals and materials offered for importation from many countries. These collections include the following: Amblyomma cajennense, A. dissimile, A. testudinis, A. maculatum, or A. spp. from equines, iguanas, deer or hedge hogs, shipped from Guatemala, Mexico, Columbia, Venezuela, Costa Rica, or Africa; Boophilus annulatus from cattle shipped from Mexico; Boophilus microplus from horses or beef hindquarters shipped from Cuba, Costa Rica, Guatemala, Honduras, or Mexico; Boophilus decoloratus from giraffe shipped from Africa; Dermacentor nitens from equines, shipped from Puerto Rico, Cuba, Guatemala, and Venezuela; Dermacentor reticulatus from hedge hogs shipped from France; Hyalomma truncatum, H. rufipes, or H. spp. from oryx, zebra, onager, or equines shipped from Africa or Iran; Haemaphysalis leachii from hedgehogs shipped from Africa; Ixodes hexagonus from a hedge hog shipped from France; Ornithodoros amplus from bird guano shipped from Peru; Rhipicephalus evertsi evertsi, R. evertsi mimeticus, or R. pulchellus from zebra, giraffe, oryx, or hartebeest shipped from Africa or the Hanover (Germany) zoo.

## TICKS PRESENTLY IN THE UNITED STATES WHICH SERVE AS VECTORS OF DISEASE

We are quite fortunate that a number of the most destructive tick-borne diseases, which cause serious losses in other parts of the world, are not present in the United States. However, we do suffer from several tick-borne diseases spread by ticks present in this country.

Anaplasmosis may be transmitted by Argas persicus, Boophilus annulatus, B. microplus, Dermacentor albipictus, D. andersoni, D. occidentalis, D. venustus, D. variabilis, Ixodes scapularis, and Rhipicephalus sanguineus.

Bovine piroplasmosis is, of course, spread by B. annulatus and B. microplus.

Canine piroplasmosis is spread by Rhipicephalus sanguineus.

Equine piroplasmosis is possibly spread by Dermacentor nitens as well as Rhipicephalus sanguineus.

Tularemia can be spread by ticks including Amblyomma americanum, Dermacentor venustus, and D. variabilis.

Colorado tick fever is spread by Dermacentor andersoni, D. venustus, and perhaps D. variabilis.

Q. Fever is spread by Dermacentor andersoni, D. venustus, and perhaps Amblyomma americanum.

Dermacentor andersoni, D. variabilis, D. venustus, and perhaps other ticks such as Amblyomma americanum and A. cajenneuse serve as vectors of Rocky Mountain Spotted Fever.

Dermacentor andersoni, D. variabilis, D. venustus, Amblyomma maculatum and A. americanum cause tick paralysis

Argus persicus is the chief vector of avian spirochaetosis.

Relapsing fever of man is spread by Otobius turicata.

Ticks presently established in this country could also serve as vectors of exotic diseases should the disease agents gain a foothold in this country.

## FLORIDA REPORTS RESULTS OF TICK SURVEY

All livestock in southern Florida were inspected for cattle fever ticks as an important part of the tick eradication program. All ticks found on any species were sent to specialists to assure accurate identification.

During the period July 1, 1960 to February 28, 1962, the following data was developed:

Black-legged ticks, Ixodes scapularis, were found on 1350 bovines, 77 equines, 10 canines, 11 deer, 5 bob cats, 1 house cat, 1 mouse, 6 foxes, 10 skunks, 91 opossums, 2 rats, and 2 raccoons.

Lone star ticks, Amblyomma americanum, were found on 443 bovines, 6 equines, 1 canine, 3 deer, and 1 porcine.

Gulf Coast ticks, Amblyomma maculatum, were found on 671 bovines, 42 equines, 1 canine, 21 deer, and 1 porcine.

American dog ticks, Dermacentor variabilis, were found on 506 bovines, 46 equines, 2 canines, 7 deer, 1 bird, 104 opossums, 6 skunks, 1 rabbit, 1 rat, 6 raccoons, 9 bob cats, and 1 fox.

Tropical horse ticks, Dermacentor nitens, were found on 44 bovines, 128 equines, and 1 deer.

Brown dog ticks, Rhipicephalus sanguineus, were found on 28 bovines, 2 equines, 19 canines, 1 opossum, and 1 human.

Rabbit ticks, Haemaphysalis leporis-palustris, were found on 33 rabbits.

Four Ixodes cookei ticks were found on skunks, five Amblyomma dissimile ticks were found on snakes, 15 Amblyomma tuberculatum ticks were found on gopher tortoises, and two Ornithodoras turicata ticks were found on one skunk and one opossum.

Boophilus microplus were found on 16 premises and red ticks, Rhipicephalus evertsi, were found at Africa U.S.A., Boca Raton, Florida, and Busch Gardens, Tampa, Florida. R. pulchellus ticks were also found at the latter location.

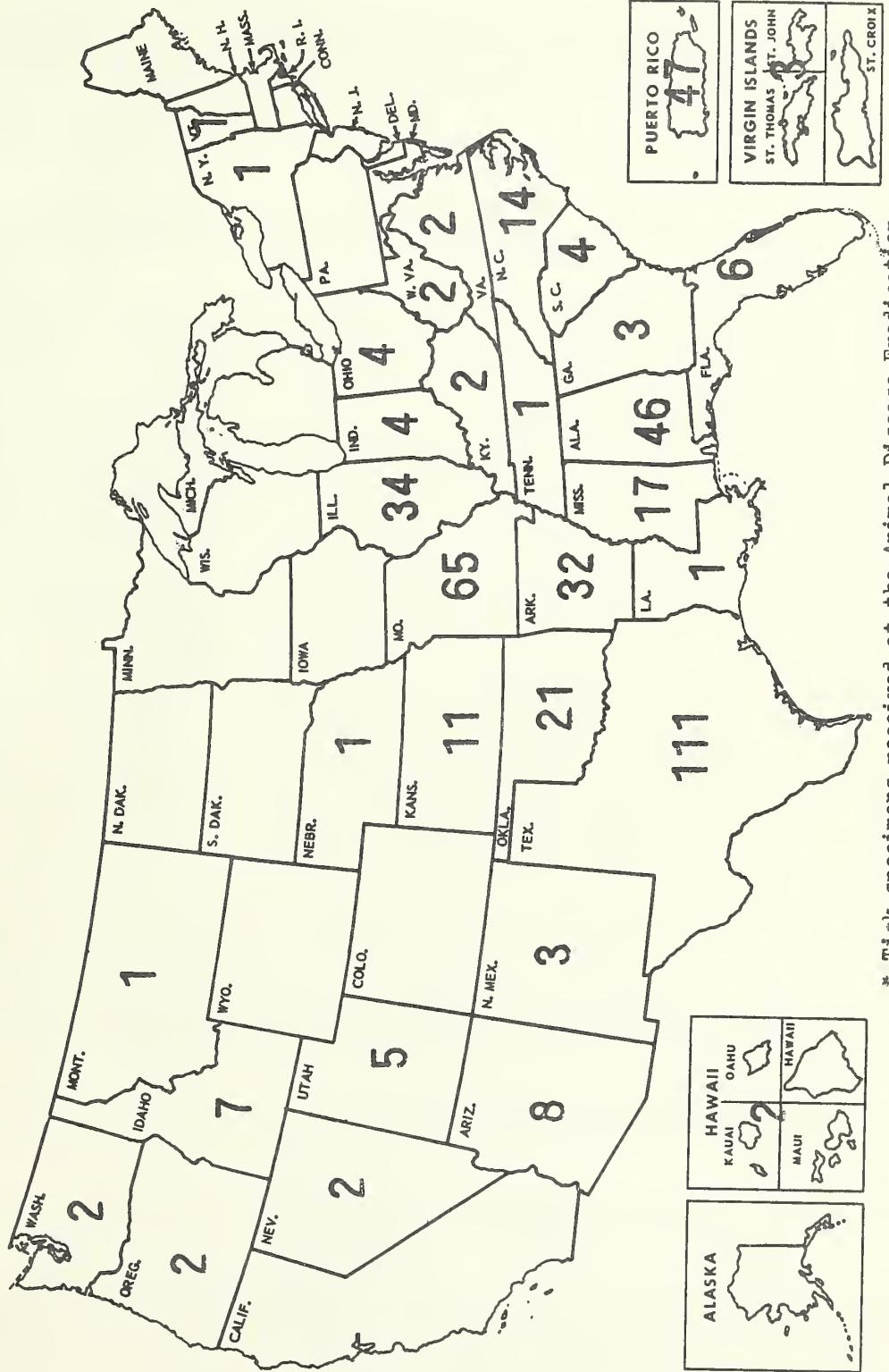
ADE DIVISION PARASITE REFERENCE CENTER, LABORATORY SERVICES  
BELTSVILLE, MARYLAND, REPORTS PROGRESS IN NATIONAL TICK SURVEYS

Instructions for initiation of a Nationwide Livestock Tick Survey are detailed in ADE Division Memorandums No. 510.5 dated December 8, 1961, and No. 510.19 dated May 15, 1962.

A summary of the tick survey information developed during the period January 1 to September 10, 1962, is given on the accompanying map and table.

In addition to collections made by field personnel, specimens sent from the following public stockyards were included in the summary: St. Louis National Stock Yards, National Stock Yards, Illinois (123); National Stock Yards, Little Rock, Arkansas (19); Indianapolis, Indiana, Stock Yards (4); Mississippi Valley Stock Yards, St. Louis, Missouri (4); Evansville, Indiana, Union Stock Yards (2); Portland, Oregon, Union Stock Yards (2); Wichita, Kansas, Union Stock Yards (2); and Fort Worth, Texas, Stock Yards (1).

## SUMMARY OF TICK SURVEY \*



\* Tick specimens received at the Animal Disease Eradication Division, Laboratory Services, Parasite Reference Center, Beltsville, Maryland, during the period January 1, 1962 to September 10, 1962.

## S U M M A R Y O F T I C K S U R V E Y \*

State	<u>Amblyomma</u> <u>westi</u> <u>Hosts</u>	<u>Amblyomma</u> <u>coquilletti</u> <u>Hosts</u>	<u>Amblyomma</u> <u>fuscum</u> <u>Hosts</u>	<u>Babophilus</u> <u>microplus</u> <u>Hosts</u>	<u>Babophilus</u> <u>sp.</u> <u>Hosts</u>	<u>Dermacentor</u> <u>andersoni</u> <u>Hosts</u>	<u>Dermacentor</u> <u>nitens</u> <u>Hosts</u>	<u>Dermacentor</u> <u>parumapertus</u> <u>Hosts</u>	<u>Ixodes</u> <u>cookei</u> <u>Hosts</u>	<u>Ixodes</u> <u>sp.</u> <u>Hosts</u>	<u>Oribatidium</u> <u>microde</u> <u>Hosts</u>	<u>Rhipicephalus</u> <u>microplus</u> <u>Hosts</u>	
Alabama	C(4) S(1)			C(1) D(2)					C(1)			D(1)	
Alaska									C(1) M(1) D(1) S(1)				
Arizona	C(2)											C(1)	
Arkansas	C(17) D(2)								C(1)			D(1)	
California													
Colorado													
Connecticut													
Delaware													
Florida												H(5)	
Georgia													
Hawaii													
Idaho													
Illinois	C(7) S(1) D(1)								E(1) W(1) E(1) H(1)	B(1) K(1) E(1) H(1)		H(1)	
Indiana										C(8) D(1) F(1) S(1)			
Iowa										M(1) S(1)			
Kansas	C(7)									C(3) G(1)			
Kentucky													
Louisiana													
Maine												Z(1)	
Maryland	H(1)											D(1)	
Massachusetts										C(6) M(1)			
Michigan													
Minnesota													
Mississippi	C(9) D(2) C(5)									C(2) D(4) C(12) S(1)			
Missouri										D(2)			
Montana													
Nebraska													
Nevada													
New Hampshire													
New Jersey													
New Mexico	C(1)												
New York													
North Carolina	C(1)												
Ohio													
Oklahoma	C(1) P(1) D(1) M(1)												
Oregon													
Pennsylvania													
Rhode Island													
South Carolina	C(1)												
South Dakota													
Tennessee													
Texas	C(30) H(2) D(1)	H(1)	C(1)	C(1) H(1)	C(6) D(1)	C(16) H(3)	C(5)	C(1)	C(1)	H(1)	C(15) D(2)		
Utah													
Vermont													
Virginia													
Washington													
West Virginia													
Wisconsin													
Wyoming													
Puerto Rico													
Virgin Islands									C(3)				
										H(25)			

Key:      B - Bear      E - Elk      M - Man      S - Swine  
           C - Cat      D - Sheep      W - Moose      Y - Reptile  
           D - Dog      R - Rabbit      X - Deer  
           ( ) - Number of lots submitted

\* Tick specimens received at the Animal Disease Eradication Division,  
   Laboratory Services, Parasite Reference Center, Beltsville, Maryland,  
   during the period January 1, 1962 to September 10, 1962.



